HUC 10280201 – Upper Chariton Subbasin
HUC 10280202 – Lower Chariton Subbasin
Water body ID#: 0640 and 0674
Pollutant(s): Pathogens as indicated by *Escherichia coli*

MISSOURI NATURAL RESOURCES

WATER PROTECTION PROGRAM

Total Maximum Daily Load
Implementation Plan

for

Chariton River Watershed
HUC 10280201 and HUC 10280202

Putnam, Sullivan, Linn, Chariton, Randolph, Macon, Adair, and Schuyler counties

Pollutants of concern: Pathogens

Completed: Feb. 8, 2017

SUMMARY of IMPAIRED WATER BODIES

Chariton River Watershed Total Maximum Daily Load (TMDL) Implementation Plan
Pollutant(s): Pathogens as indicated by *E. coli*

Stream Names: Chariton River and Mussel Fork

Location of the
Chariton River watershed

Watershed Hydrologic Unit Code (HUC) and Name:[1]
10280201 – Upper Chariton Subbasin
10280202 – Lower Chariton Subbasin

Water Body Identification Number and Hydrologic Class:[2]
0640 – Chariton River Class P
0674 – Mussel Fork Class C

Designated Uses:[3]
Irrigation
Human health protection
Secondary contact recreation
Livestock and wildlife protection
Drinking water supply (Mussel Fork)
Whole body contact recreation category B (Mussel Fork)
Whole body contact recreation category A (Chariton River)
Protection and propagation of fish, shellfish and wildlife – warm water habitat

Impaired Designated Uses:
Whole body contact recreation category A (Chariton River)
Whole body contact recreation category B (Mussel Fork)
Secondary contact recreation (Mussel Fork)

Other Designations:
Outstanding state resource water (Chariton River within Rebel's Cove Conservation Area)

Pollutant Identified on the 303(d) List:
Escherichia coli, or *E. coli* (fecal indicator bacteria)

Lengths and Locations of Impaired Segments:
0640 – 178.6 kilometer (111 miles), from mouth to state line
0674 – 46.7 km (29 mi), from Sec. 18, T58N, R17W to Sec. 2, T62N, R18W

[1] The hydrologic unit code, or HUC, system is a way to classify watersheds by size. This is a national system used to communicate the size and relationship of watersheds. Every hydrologic unit is identified by a unique HUC, a number containing two to 12 digits. The more digits the HUC number contains, the smaller the watershed.
[2] For hydrologic classes see 10 CSR 20-7.031(1)(F). Class P streams maintain flow during drought conditions. Class C streams may cease flow during dry periods, but maintain permanent pools that support aquatic life.
[3] For designated uses see 10 CSR 20-7.031(1)(C) and 10 CSR 20-7.031 Table H. Presumed uses are assigned per 10 CSR 20-7.031(2)(A) and (B) and are reflected in the Missouri Use Designation Dataset described at 10 CSR 20-7.031(2)(E).

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1 – Introduction

A total maximum daily load, or TMDL, identifies water quality problems, possible causes of those problems, and provides targets for restoration. Real water quality improvements, however, are often dependent upon actions and support from local communities and landowners residing within the watershed. This document is a supplemental planning document to aid in the implementation of activities in the Chariton River watershed that will address the goals established in the Chariton River and Mussel Fork *E. coli* TMDL reports. Although separate, this implementation plan should be considered a companion to those reports. The purpose of this implementation plan is to serve as a general guide to permit writers, nonpoint source program coordinators, and other department staff, as well as Soil and Water Conservation districts, local governments, permitted entities, regional planning commissions, watershed managers, and citizen groups for achieving the wasteload and load allocations established in the TMDL. The *E. coli* TMDL for the Chariton River is available on the department's website at dnr.mo.gov/env/wpp/tmdl/0640-chariton-r-record.htm and the TMDL for Mussel Fork is available at dnr.mo.gov/env/wpp/tmdl/0674-mussel-fk-ck-record.htm. Questions regarding these TMDLs may be sent via email to tmdl@dnr.mo.gov or by calling the department's Watershed Protection Section at 573-751-5723.

The department recognizes that technical guidance and support are critical for achieving the goals of a TMDL. While the TMDLs establish the maximum bacteria loading that the Chariton River and its tributary Mussel Fork can assimilate and still meet water quality standards, this implementation plan provides additional information regarding best management practices, potential participants in the watershed, and calculations of pollutant reductions in order to guide implementation activities that will eventually restore attainment of water quality standards. This plan is not intended to prescribe or prohibit any specific practices or technologies to reduce bacteria loading in the Chariton River watershed. Nor is it intended to serve as the sole means of remediation and restoration of impaired water bodies in the watershed. Any existing Section 319 9-element watershed based plans that address regions or subwatersheds within the Chariton River watershed should be updated to incorporate the goals and strategies outlined in this plan. Any such plans or other known management practices already in place that will aid in meeting the goals established in the TMDLs are referenced in this plan in order to facilitate those efforts without duplicating the work.

Because the TMDLs address bacteria loading from all potential sources in the Missouri portion of the Chariton River watershed, this implementation plan provides guidance for meeting the established loading targets assigned to both point and nonpoint sources.[4] Point sources of pollution are regulated through the Clean Water Act. Any reduction in bacteria loading from these sources will primarily be completed through the Missouri State Operating Permit program along with any other enforcement or legal actions administered for compliance with this law (see Section 6.1). Nonpoint sources of pollution are not regulated through permits and any reductions from these sources will rely on the voluntary implementation of best management practices, or BMPs, in the watershed (see Section 6.2). Voluntary practices will be the primary means for achieving the water quality goals of both the Chariton River and Mussel Fork TMDLs.

The location of the impaired water body segments addressed by the *E. coli* TMDLs are presented on the next page in Figure 1.

[4] Point and nonpoint sources are defined and discussed in Section 4 of the Chariton River *E. coli* TMDL.

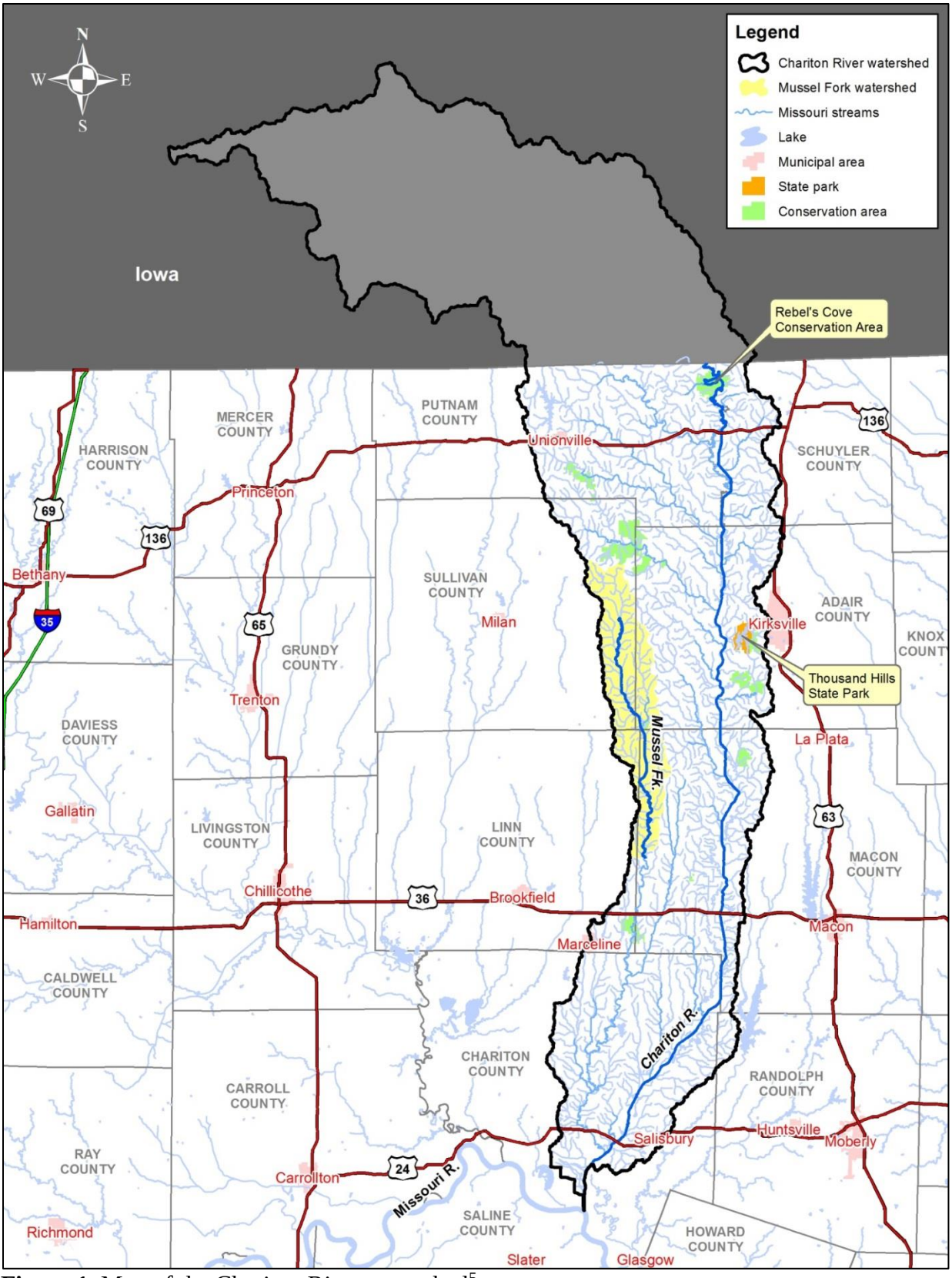

Figure 1. Map of the Chariton River watershed[5]

[5] Targets established in the Chariton River *E. coli* TMDL are for Missouri sources only. Modeling for TMDL development assumed bacteria contributions from Iowa met water quality standards at the state line.

2 – Targeted Participants and Potential Roles in Implementation

TMDL implementation is carried out in part by the department through the Missouri State Operating Permit program for point sources and for nonpoint sources through projects and cost-share practices funded in part by grants or subgrants from the department's Section 319 Nonpoint Source Implementation Program and the Soil and Water Conservation Program. Additional implementation can be completed through actions taken by local governments, citizen groups, and others with an interest in improving water quality in their communities. Successfully meeting the goals of the TMDL will require participation and cooperation from the various parties within the watershed with roles ranging from technical support to actual on-the-ground implementation of BMPs. Groups and agencies that may potentially be involved in the TMDL implementation process are identified below, along with descriptions of their possible roles. This list is not exhaustive and is not intended to compel participation from any organization; nor is it meant to exclude those who are not listed, but may be interested in participating.

- Department of Natural Resources
    - Administer statutory authorities granted by Missouri clean water law
    - Ensure permits issued in the watershed are consistent with the assumptions and requirements of TMDL wasteload allocations per federal regulations
    - Provide compliance assistance, inspections, and enforcement actions to regulated entities as appropriate
    - Provide technical support to watershed groups as appropriate
    - Serve as a potential source of financial assistance for watershed plan development or BMP implementation through Section 319, 604(b) grants, or Soil and Water Conservation Program cost-share practices
    - Serve as a potential source of financial assistance for infrastructure improvements through low-interest State Revolving Fund loans
    - Assess compliance with water quality standards on a biennial basis in accordance with Sections 303(d) and 305(b) of the Clean Water Act
    - Coordination of watershed planning efforts and promote stakeholder involvement through the Our Missouri Waters Initiative
- Domestic wastewater dischargers in the Chariton River watershed
    - Operate facility in compliance with stated permit limits and conditions
    - Maintain and operate disinfection equipment as appropriate for the technology in use
- County Soil and Water conservation districts
    - Provide financial incentives to agricultural producers for the implementation of conservation practices that help prevent soil erosion
    - Provide technical assistance with design, implementation and maintenance of conservation practices
- University of Missouri Extension
    - Technical assistance with nonpoint source and watershed management issues
    - Assistance in organizing locally led watershed groups
- Missouri Department of Conservation
    - Technical assistance with stream and watershed management issues
    - Promote maintenance and reestablishment of functional riparian corridors

- Missouri Department of Health and Senior Services
  - Technical assistance, regulatory authority, and, in some cases, the permitting authority for onsite wastewater treatment systems
- County health departments
  - Technical assistance and, in some cases, the regulatory and permitting authority for onsite wastewater treatment systems
- Local municipal and/or county governments
  - May create local ordinances pertaining to onsite wastewater treatment systems
  - Zoning authority for determining land use planning, which may be used as a tool for stream protection
  - May create set-back requirements and other riparian protections
  - Use, promote, or require green infrastructure and low-impact development
- Iowa Department of Natural Resources
  - Ensure discharge permits contain limits or conditions adequate for the protection of downstream uses in Missouri
  - Coordinate efforts to reduce nonpoint source loading into Missouri
- Locally led watershed groups
  - May apply for Section 319 subgrants
  - Help identify critical areas at a local level
  - Voluntary implementation of BMPs
  - Public education and outreach
  - Volunteer water quality monitoring
- Stream Team volunteers[6]
  - Volunteer Water Quality Monitoring program - *E. coli* monitoring may be conducted at the Cooperative Stream Investigation, or CSI, level[7]
  - Stewardship (e.g., litter pick up and storm drain stenciling)
  - Advocacy
  - Education
- General public within the Chariton River watershed
  - Voluntary lifestyle changes (e.g., pet waste cleanup, septic system maintenance, water conservation, erosion control practices, etc.)
  - Voluntary implementation of BMPs on private lands, residences and businesses

[6] The Missouri Stream Team Program is a partnership between the Department of Natural Resources, the Department of Conservation, the Conservation Federation of Missouri, and the citizens of Missouri. The Stream Team Program provides an opportunity for all citizens to get involved in river conservation. Additional information regarding the Stream Team program is available online at mostreamteam.org.

[7] More information regarding the Volunteer Water Quality Monitoring, or VWQM, program is available online at dnr.mo.gov/env/wpp/VWQM.htm. CSI level monitoring uses EPA approved and accepted analytical methods as well as standard analytical methods developed for the VWQM program. More information regarding the CSI level of training is available on the department's website at dnr.mo.gov/env/esp/csi.htm.

3 – Why is a TMDL Needed for Streams in the Chariton River Watershed?

Section 303(d) of the federal Clean Water Act and Chapter 40 of the Code of Federal Regulations Part 130 requires states to develop TMDLs for waters not meeting applicable water quality standards. Missouri's Water Quality Standards consist of three major components: designated uses, water quality criteria to protect those uses and an antidegradation policy. Descriptions of each of these components can be found in Section 5 of the Chariton River TMDL and Section 3 of the Mussel Fork TMDL. The water body segments addressed in these TMDLs are not attaining their designated recreational uses due to exceedances of the state's numeric criteria for *E. coli* bacteria. High counts of *E. coli* are an indication of fecal contamination and an increased risk of pathogen induced illness. A summary of the available *E. coli* data for the Chariton River is presented in Table 6 of the Chariton River TMDL report and data for Mussel Fork can be found in Table 4 of the Mussel Fork TMDL report. The department determines a water to be impaired by pathogens if the *E. coli* criteria are exceeded in any of the last three years for which there is a minimum of five samples taken during the recreational season. The state's recreational season is defined in rule as being from April 1 to October 31. Table 1 below presents the recreational uses specific to the water body segments addressed by the Chariton River *E. coli* TMDL.

Table 1. Designated recreational uses of the bacteria impaired water bodies

Stream Name	***Water Body ID Number***	***Designated Recreational Uses****
Chariton River	0640	WBC-A and SCR
Mussel Fork	0674	WBC-B and SCR

* WBC-A = whole body contact recreation category A
WBC-B = whole body contact recreation category B
SCR = secondary contact recreation

Designated uses for water bodies in Missouri are identified in the state's Water Quality Standards at 10 CSR 20-7.031. The Clean Water Act at Section 101(a)(2) requires that wherever attainable, waters be designated with uses that provide for recreation in and on the water. Missouri's Water Quality Standards include three recreational uses. These uses include whole body contact recreation category A, whole body contact recreation category B, and secondary contact recreation. Whole body contact recreation includes activities in which there is direct human contact with surface water that results in complete body submergence, such as swimming. During such activities, accidental ingestion of the water may occur and there is direct contact to sensitive body organs, such as the eyes, ears and nose. Category A waters include water bodies that have been established by the property owner as public swimming areas welcoming access by the public for swimming purposes and waters with documented existing whole body contact recreation uses by the public (10 CSR 20-7.031(1)(C)2.A.(I)). Category B applies to waters designated for whole body contact recreation, but are not contained within category A (10 CSR 20-7.031(1)(C)2.A.(II)). Secondary contact recreation includes activities in which there is limited, incidental or accidental contact with the water and the probability of ingesting appreciable quantities of water is minimal. Such activities include boating, fishing and wading (10 CSR 20-7.031(1)(C)2.B.).

4 – Review of Sources of Bacteria Loading in the Chariton River Watershed

Section 4 and Appendix C of the Chariton River *E. coli* TMDL contains a comprehensive inventory and assessment of all known and suspected sources of bacteria in the watershed. Sources specific to the drainage area of Mussel Fork are described in Section 5 of the Mussel Fork TMDL report. In both TMDLs, sources are categorized as being either point sources or nonpoint sources. Although the watershed extends north into Iowa, the Chariton River TMDL assumes that Missouri water quality standards are being met at the state line. For this reason, wasteload and load allocations were established only for sources located within the Missouri portion of the watershed and this implementation plan focuses only on achieving the loading targets established for those sources. Even so, communication and coordination with Iowa may be beneficial and necessary in order to improve the overall water quality in the Chariton River watershed. Such communication can be completed through the department's watershed planning initiatives or by local governments and watershed groups. The Iowa Department of Natural Resources' Water Quality Bureau in Des Moines can be contacted at 515-725-8200.

The bacteria sources identified in the TMDL are based on issued permits and general knowledge of watershed conditions. For some sources, specific loading contributions remain unknown. Groups interested in implementing practices in the subwatersheds of the Chariton River may want to consider employing microbial source tracking techniques to better identify the primary sources of *E. coli* in their area (i.e., poultry, equine, cattle, domestic pets, wildlife and humans). However, such techniques can be cost prohibitive and may be unnecessary if localized land use conditions are already well known. More information regarding microbial source tracking techniques is available online from the U.S. Geological Survey at water.usgs.gov/owq/microbial.html.

4.1 - Point Sources

Point sources are typically regulated through the Missouri State Operating Permit program, which is the state's program for administering the federal National Pollutant Discharge Elimination System, or NPDES, program. The NPDES program requires all point sources that discharge pollutants to waters of the United States to obtain a permit. Permitted activities identified in the TMDL reports as being potentially contributing sources of bacteria loads to streams in the Chariton River watershed include municipal and domestic wastewater dischargers and concentrated animal feeding operations, or CAFOs.[8] In addition to these permitted facilities, illegal straight pipe discharges of domestic wastewater are another potential point source contributor of bacteria in the watershed.

4.1.1 Municipal and Domestic Wastewater Discharge Permits

Domestic wastewater is primarily household waste, which includes graywater and sewage. Although this wastewater is treated prior to discharge, any effluent that is not adequately disinfected can be a significant source of bacteria. Such loading from domestic dischargers is typically evident under low flow conditions when stormwater influences are less or nonexistent. However, in addition to permitted discharges, such facilities may also unintentionally contribute bacteria loads through accidental sanitary sewer overflows. Sanitary sewer overflows are unpermitted discharges of untreated or partially treated wastewater and are not authorized by the Clean Water Act. Such overflows can occur under dry weather conditions due to power failures,

[8] Although the watershed contains portions of the City of Kirksville, which is regulated by a municipal separate stormwater sewer system, or MS4, permit, the TMDL concluded that urban runoff is not a significant contributor of bacteria loading to the impaired water bodies. For this reason, no specific wasteload allocation was calculated for the MS4 and no pollutant reductions associated with stormwater discharges from this system are required in order to implement the TMDL.

line breaks or blockages, or can occur under wet weather conditions if the sewer system becomes overwhelmed by excess stormwater infiltrating the sewers. Since sanitary sewer overflows are not legal discharges, the TMDL assigns these point sources a wasteload allocation of zero

In Missouri, there are 14 domestic wastewater treatment facilities in the watershed. Two of these facilities, Green Castle and Green City, are also located within the subwatershed of Mussel Fork. Wasteload allocations for these facilities are static and do not vary with flow. An aggregated wasteload allocation for these facilities can be found in Section 8 of the Chariton River TMDL document, and specific facility wasteload allocations for Green Castle and Green City are presented in Section 8 of the Mussel Fork TMDL.

Appendix C of the Chariton River TMDL report also notes the presence of 11 additional domestic wastewater dischargers in the Iowa portion of the Chariton River watershed. Although the department cannot impose TMDL wasteload allocations onto another state, federal regulations at 40 CFR §131.10(b) require states to establish water quality standards that provide for and maintain the water quality of downstream waters, including those in other states. In practice, implementation of this regulation is carried out in part through the development of permits with limits that allow for the maintenance of downstream water quality standards. Therefore, it is expected that permitted point sources in Iowa will have limits stringent enough to ensure the protection of Missouri's Water Quality Standards and that those standards will be met at the state line.

4.1.2 – Concentrated Animal Feeding Operations (CAFOs)

Concentrated Animal Feeding Operations, or CAFOs, are typically animal feeding operations that confine and feed or maintain animals for 45 days or more in any 12-month period, and confine more than 1,000 animal units. Facilities with fewer animal units may be permitted as CAFOs voluntarily, if discharges occur or other water quality issues are discovered per 10 CSR 20-6.300. Animal wastes generated from CAFOs that are carried through stormwater runoff or by wastewater discharges can be a source of bacteria to water bodies (Rogers and Haines 2005). All CAFO facilities are permitted as no-discharge facilities and store wastewater in lagoons and land apply accordingly. Assuming all permit conditions are met, including those associated with land applications, CAFO facilities should not be contributing significant bacteria loads to the Chariton River or its tributaries. For this reason, the wasteload allocation assigned in the TMDLs for all CAFO facilities is zero at all flows.

4.1.3 - Illicit (Illegal) Straight-Pipe Discharges

Illicit straight-pipe discharges of domestic wastewater are another potential point source of bacteria. These types of sewage discharges bypass treatment systems, such as a septic tank or a sanitary sewer, and instead discharge directly to a stream or an adjacent land area (Brown et al. 2004). Straight-pipe discharges are illegal and are not permitted under the Clean Water Act. At present, there are no data about the presence or number of illicit straight-pipe discharges in the Chariton River watershed. Nor are there any data available to suggest that straight-pipe discharges are a problem in the watershed. Due to the illegal nature of these discharges, any illicit straight-pipe discharges must be eliminated. Since there is no legally allowable discharge from these sources, neither TMDL allocates a portion of the loading capacity to straight-pipe discharges. Straight-pipe discharges are assigned a wasteload allocation of zero.

4.1.4 – Future Point Sources (New Permitted Facilities)

No specific portion of the loading capacity calculated in either TMDL is allocated to a reserve capacity for new dischargers. Analysis of existing population data and land cover data indicate little change from past conditions and a low likelihood of a need for such an allocation. Even so, the wasteload allocations presented in the TMDL reports do not preclude the establishment of future point sources in the watershed. Future point sources should be evaluated against the TMDL and the range of flows, which any additional bacterial loading will affect, as well as any additional requirements associated with anti-degradation. Such an evaluation may be necessary when applying for a permit as a new discharger. Per federal regulations at 40 CFR 122.4(a), no permit may be issued when the conditions of the permit do not provide for compliance with the applicable requirements of the Clean Water Act, or regulations promulgated under the Clean Water Act. Additionally, 40 CFR 122.4(i) states no permit may be issued to a new source or new discharger if the discharge from its construction or operation will cause or contribute to violation of water quality standards. All application procedures for new dischargers must be followed. Such information is available online on the department's website at dnr.mo.gov/env/wpp/permits/ww-construction-permitting.htm or by calling the department at 573-751-1599.

New CAFOs and domestic wastewater treatment facilities that are permitted as no-discharge facilities should not contribute additional bacteria loading to the impaired water bodies and therefore do not require a specified wasteload allocation for operation. If allowed, however, land applications from these new facilities must be conducted in accordance with the requirements and conditions of the permit to ensure no additional loading from such activities is occurring and that the sum of the TMDL wasteload allocations are not being exceeded. Other general and stormwater permitted activities not associated with domestic wastewater or CAFOs are not expected to actively generate bacteria and compliance with all permit conditions is assumed to result in loading at *de minimis* levels. Information regarding no-discharge wastewater treatment is available on the department's website at dnr.mo.gov/env/wpp/no-discharge.htm. Listed below are some discharge alternatives that new facilities may consider to ensure the established wasteload allocations are met:

- Eliminate all surface water discharges by using land treatment options (e.g., spray irrigation or soil treatment systems)
- Implement pollution prevention actions or treatment to eliminate other pollutant sources
- Discharge to a permitted wastewater treatment facility that has capacity to treat the pollutant within their established wasteload allocation

In some instances a potential source may be re-categorized from a nonpoint source to a point source (e.g., newly designated or permitted stormwater). If such a source's magnitude, character, and location remain unchanged, then the appropriate portion of the load allocation may be assigned as a wasteload allocation. Wasteload allocations between point sources may also be shifted appropriately between individual point sources where pollutant loading has shifted as long as the sum of the wasteload allocations is unchanged. Advanced notification to EPA before permitting with shifts in the established wasteload allocation is recommended (EPA 2012).

4.2 - Nonpoint Sources

Nonpoint source pollution refers to pollution coming from diffuse, non-permitted sources that typically cannot be identified as entering a water body at a single location. They include all other categories of pollution not classified as being from a point source, and are exempt from department

permit regulations per state rules at 10 CSR 20-6.010(1)(B)1. These sources usually involve stormwater runoff and are often minor or negligible under low-flow conditions. Nonpoint sources identified in the TMDL reports to have a potential to contribute bacteria loads in the Chariton River watershed are onsite wastewater treatment systems, runoff from both agricultural lands and urban spaces, and natural background contributions. The load allocations calculated for the Chariton River and Mussel Fork represent the sum of all nonpoint sources draining to those waters and were calculated as the remainder of the loading capacity after allocations to point sources and the margin of safety.

4.2.1 – Onsite Wastewater Treatment Systems

When properly designed and maintained, onsite wastewater treatment systems (e.g., home septic systems) should not serve as a source of contamination to surface waters; however, onsite wastewater treatment systems do fail for a variety of reasons. Failing onsite wastewater treatment systems are known to be sources of bacteria, which can reach nearby streams through surface runoff and groundwater flows, thereby contributing bacteria loads under either wet or dry weather conditions. The Chariton River TMDL estimates that there are approximately 9,332 onsite wastewater treatment systems in the watershed. Potentially up to 50 percent of those systems may be failing. Since a properly functioning onsite system by design should not be contributing significant bacteria loads to streams in the watershed, no portion of the loading capacity is allocated to these sources. The load allocation assigned in the TMDLs to onsite wastewater treatment systems is zero at all flows.

4.2.2 – Agricultural Runoff

Stormwater runoff from lands used for agricultural purposes is a potential source of bacteria loading to surface waters. Activities associated with agricultural land uses that may contribute *E. coli* to a water body include manure fertilization of croplands or pastures, and livestock production. According to the Chariton River TMDL report, cropland in the Missouri portion of the watershed accounts for 20 percent of the total area. Likewise, grassland areas where livestock may be grazing account for more than 43 percent of the watershed area. Because the watershed has significant amounts of grassland and pasture, the number of small animal feeding operations, or AFOs, that do not require state operating permits is presumably high. Loading from nonpoint source agriculture is accounted for in the TMDL as part of the load allocation.

4.2.3 – Urban Runoff

Stormwater runoff from urban areas is another potential source of bacteria loading to surface waters. Runoff can become contaminated directly through contact with pet and wildlife wastes, or may carry contaminated sediments via erosion. Because urban areas account for only 0.4 percent of the total watershed area, the TMDL concludes that urban runoff is not likely to be a significant contributor to bacteria impairments in the watershed. Any bacteria loading from urban areas in the watershed is accounted for in the TMDL load allocations.

4.2.4 – Natural Background Contributions

Wildlife such as deer, waterfowl, raccoons, rodents, and other animals contribute to the natural background concentrations of *E. coli* that may be found in a water body. Due to the lack of watershed specific data on the potential bacteria contributions from wildlife, no estimation on the significance of such contributions can be made. For TMDL purposes, wildlife contributions are considered in the total nonpoint source load as part of the established load allocation. No specific

pollutant reductions from wildlife sources are expected to be necessary to achieve the loading targets established in the TMDL and implementation activities should focus on pollutant reductions from anthropogenic sources.

5 – Existing Loads and Needed Reductions

A water quality impairment occurs when existing pollutant loading to a water body exceeds that water body's assimilative capacity for that pollutant. In order to restore the impaired water body to a condition that meets water quality standards, existing pollutant loading must be reduced. Therefore, reducing *E. coli* loading to the Chariton River and Mussel Fork from existing levels to levels equal to or less than the loading capacities calculated in the TMDL reports should result in attainment of water quality standards. A portion of the calculated loading capacities is allocated to a margin of safety to ensure that loading reductions from the various point and nonpoint sources in the watershed are adequate for achieving this goal.

In order to develop TMDL targets and allocations specific to pollutant sources in Missouri, EPA assumed during the modeling of the Chariton River TMDL that Missouri water quality standards were met at the state border with Iowa. Despite this assumption, approximately 106 miles of the Chariton River flows through Iowa before entering Missouri. Additionally, the sample site where data was collected and used in the assessment of the Chariton River is located 23.7 miles upstream of the Missouri border in Iowa. For this reason, load reductions from potential pathogen sources in Iowa should be considered in the overall planning of restoring the Chariton River to conditions that attain Missouri's designated recreational uses. However, since the TMDL provides targets only for Missouri point and nonpoint sources, the available assessment data is inadequate to estimate needed reductions from these sources.

Since the establishment of the TMDL, the U.S. Geological Survey has collected *E. coli* data from the Chariton River near Prairie Hill (approximately 8 miles north of Salisbury). Unfortunately, the samples collected during the recreational seasons of 2013, 2014, and 2015 numbered fewer than five samples in each year, so were insufficient in number for water quality assessment purposes as described in the department's 2014 and 2016 listing methodology documents.[9] Even so, this data indicates that the *E. coli* criterion may have been exceeded in 2014 and 2015 as the geometric means calculated from the available data during these years are 348 counts/100mL and 382 counts/100mL respectively. These values represent the need for a 64 to 67 percent reduction in the *E. coli* geometric mean in order to attain the water quality *E. coli* criterion of 126 counts/100mL. Achievement of the 126 count/100mL criterion can occur through reductions in the magnitude of individual *E. coli* measurements, reductions in the frequency of *E. coli* measurements that exceed the criterion concentration, or, most likely, through a combination of reductions in both the magnitude and frequency of *E. coli* excursions.

The Mussel Fork TMDL provides specific loading targets and allocations for a segment of Mussel Fork. The *E. coli* data presented in this report are sufficient for estimating existing bacteria loading into Mussel Fork by flow condition as well as for estimating the amount of reduction needed to achieve the targeted load. Individually observed bacteria measurements collected during the recreational seasons of 2010 through 2014 were plotted on the Mussel Fork load duration curve

[9] Past and present versions of the department's 303(d) Listing Methodology Document, used to assess water quality attainment in surface waters, are available online at dnr.mo.gov/env/wpp/waterquality/303d/303d.htm.

shown in Figures 8 of the Mussel Fork TMDL. Since the bacteria criterion for the protection of whole body contact recreation category B is expressed as a geometric mean, the loads calculated from individually observed measurements cannot be directly compared to the TMDL curve as a means to estimate overall existing loading or needed reductions. Therefore, geometric means of the observed data within each specific flow range were calculated to make a comparison. The calculated geometric means, presented in Table 2, represent estimates of existing loading to Mussel Fork at the specified flow conditions. These estimates represent loading from both point and nonpoint sources in the watershed as the available data is inadequate for estimating existing loading from specific sources. An estimation of the amount of load reduction needed at each flow condition to achieve the TMDL target can be estimated by calculating the difference of the estimated existing load from the loading capacity. Implementation actions that reduce loading during the flow conditions where the geometric mean of the observed data exceed the load duration curve will provide the greatest water quality benefit. Because the recreational use criterion is a geometric mean, it may also be possible to achieve the water quality criterion by reducing the frequency and magnitude of individual excursions at any flow condition.

Table 2. Estimated loading and needed reductions for Mussel Fork, water body ID 0674

Percent of time flow exceeded	***Flow Condition***	***Flow m^3/s (ft^3/s)***	***TMDL (counts/day)***	***Existing Load (counts/day)***	***Needed Reduction (%)***
95	Low Flow	0.01 (0.52)	2.62E+09	1.35E+09	0
75	Dry Conditions	0.11 (3.73)	1.88E+10	4.00E+10	53
50	Mid Range	0.52 (18.40)	9.28E+10	2.64E+12	96
25	Moist Conditions	1.78 (62.76)	3.16E+11	7.64E+12	96
5	High Flow	18.61 (657.13)	3.31E+12	No data	No data

Additional water quality monitoring sites and sampling may help determine loading from a specific source or area in the watershed and help estimate the amount of reduction needed from that particular source. Such sampling may also be useful in determining where the greatest load reductions are needed and to determine how effective treatment technologies or BMPs are in achieving those reductions. Groups are encouraged to consult with the department's Water Quality Assessment and Monitoring Unit, available at 573-526-5297, for developing a monitoring component to any localized implementation or water quality improvement plans. Other department monitoring goals are specified within Section 12 of the TMDL reports.

6 – Implementation of the TMDL

TMDLs are not self-implementing and are not in and of themselves regulatory documents. Despite this, TMDLs provide a foundation for establishing water quality goals and determining appropriate actions and controls necessary for pollutant reductions. Progress towards meeting water quality standards in the Chariton River and its tributaries is expected to be long-term, and initial TMDL implementation may be a continuation of already existing or planned activities. Except in cases where activities and schedules are required by legally binding requirements, such as a consent decree or established permit limits, an adaptive implementation approach that makes progress toward achieving water quality goals while using new data and information to reduce uncertainty and adjust implementation activities should be used. In order to assess the effectiveness of TMDL implementation, the department will routinely examine habitat, water quality, invertebrate community, and fish community data collected by other local, state and federal entities as part of its biennial assessment of water quality for Clean Water Act 305(b) and 303(d) reporting.

6.1 - Point Source Implementation (NPDES and Missouri State Operating Permits)

Federal regulations at 40 CFR §122.44(d)(1)(vii)(B) require that permit conditions be consistent with the assumptions and requirements of TMDL wasteload allocations. How these conditions are expressed can vary depending upon the nature of the discharge. Although TMDLs are required to be written for daily time increments, permit effluent limits may be written in a form that derives from, and complies with, applicable water quality standards that use any time measure [40 CFR 122.44(d)(1)(vii)(A) and EPA 2006]. The department's permit writers have discretion on how TMDL wasteload allocations are considered in the permit and for determining appropriate schedules for implementation. Permit writers should consult available permit writing handbooks and technical support documents to determine appropriate limits.[10] Although wasteload allocations are often specified for individual facilities, in some cases it may be appropriate for pollutant loadings to be shifted between the individual wasteload allocations during NPDES permitting as long as the sum of the wasteload allocations remains unchanged and is not exceeded (EPA 2012). In no cases does a TMDL wasteload allocation allow for permit limits that exceed water quality standards. If water quality standard revisions result in criteria more stringent than an established TMDL wasteload allocation, then the more stringent criteria should be used in deriving permit limits.[11] Information regarding the department's permitting process is available online at dnr.mo.gov/env/wpp/permits/index.html or by calling the department's Operating Permit Section at 573-522-4502. Point sources identified to be potential contributors of bacteria in the Chariton River watershed include municipal and domestic wastewater treatment facilities, CAFOs, and illegal straight pipe discharges.

6.1.1 – Municipal and Domestic Wastewater Discharges

Background: Municipal and domestic wastewater treatment facilities were identified in Appendix C of the Chariton River TMDL report. Two of these facilities, the Greencastle Lagoon System and the Green City wastewater treatment facility, were also identified as potential sources to Mussel Fork. In addition to wastewater discharges, bacteria loading from municipal wastewater treatment facilities may occur from sanitary sewer overflows.

[10] The department maintains a Water Pollution Control Permit Manual to provide guidance to permit writing staff and is available online at dnr.mo.gov/env/wpp/permits/manual/. Additionally the EPA maintains a National Pollutant Discharge Elimination System, or NPDES, Permit Writers' Manual online at www.epa.gov/npdes/npdes-permit-writers-manual and other technical support documents for water quality-based permitting at cfpub.epa.gov/npdes/docs.cfm?program_id=2&view=allprog&sort=name.

[11] Federal regulations at 40 CFR 131.21, also known as the "Alaska Rule," require water quality standards to be approved by EPA before they can be used for Clean Water Act purposes (i.e., water quality-based effluent limitations or TMDLs).

Objective: Reduce or maintain bacteria loading to concentrations that do not exceed water quality standards. Sanitary sewer overflows are illegal and are assigned a wasteload allocation of zero. Because bacteria loads are expressed in unmeasurable quantities (i.e., billions of bacteria per day), the focus for implementation should be achieving discharges at or below the targeted *E. coli* concentrations: 126 count/100mL for category A waters and 206/100mL for category B waters.

Strategy 1: The primary mechanism for implementing the TMDL goals for these facilities will be through specified *E. coli* limits and conditions specified in Missouri State Operating Permits that protect for whole body contact recreation designated uses. For pathogen TMDLs, appropriate *E. coli* limits are those targeting either 126 count/100mL or 206 count/100mL, whichever concentration is appropriate to maintain the whole body contact recreational use of the receiving water. Facilities already regulated with such permit limits meet the assumptions and requirements of the established TMDL wasteload allocation.

In many cases, disinfection technologies employed by domestic wastewater dischargers to comply with permitted conditions will result in bacteria loading that is much less than what has been allocated in the TMDL. Additionally, facilities' actual flows may be less than the design flows used to calculate wasteload allocations. The TMDL does not authorize facilities to violate their existing permit conditions and it is not the intent of the TMDL to allow for discharges of *E. coli* concentrations above those achieved using existing technology. Instead, use of design flows for calculating wasteload allocations instead of actual flows allows for future increases in discharge from these facilities due to increases of users and expansions of service areas.

Although some facilities in the watershed may not yet have *E. coli* permit limits or disinfection equipment, due to the water quality standard revisions described in Section 5.1.1 of the Mussel Fork TMDL, all domestic wastewater dischargers in the Chariton River watershed are expected to have *E. coli* limits and a schedule of compliance to achieve those limitations when their permits are renewed. The length of the schedule will depend on the affordability or cost analysis that must be conducted for these facilities. Facilities in the Chariton River watershed that, at the time of this writing, do not yet have *E. coli* permit limits are presented in Table 3 of this implementation plan.

Table 3. Municipal and domestic wastewater dischargers lacking *E. coli* permit limits

Facility Name	***Permit No.***	***Permit Expiration Date***
Bucklin East WWTF	MO-0085928	Dec. 31, 2017
Green Castle Lagoon System	MO-0103322	March 31, 2017
Green City WWTF	MO-0112135	March 30, 2017
New Cambria WWTF	MO-0094706	June 30, 2017
Wildflower Community WWTF	MO-0057215	July 12, 2017

Strategy 2: Sanitary sewer overflows are not authorized by the Clean Water Act, therefore no portion of the TMDL loading capacity is assigned to these sources. Facilities with sanitary sewer overflows must implement, as a condition of their operating permit, a Capacity, Management, Operation and Maintenance Plan, which is more frequently referred to as a CMOM. The EPA provides CMOM guidance at www3.epa.gov/npdes/pubs/cmom_guide_for_collection_systems.pdf. Common implementation activities for reducing sanitary sewer overflows include pipe cleaning to reduce blockages; pipe lining or replacement to reduce inflow and infiltration of outside water; public

education to reducing the input of sewer clogging fats, oils and grease; and, in some cases, increases to the sewer system's hydraulic capacity are made by enlarging pipes or by constructing storage tanks.

6.1.2 –CAFOs

Background: CAFOs are permitted as no-discharge facilities and land apply their generated wastes. The TMDL assumes that CAFOs operating in compliance with all permitted conditions will not significantly contribute bacteria loads to the impaired water bodies.

Objective: The wasteload allocation assigned to CAFO facilities is zero. Wastewater discharges from CAFOs should not occur, except in certain rare circumstances described within the permit. Land applications of animal wastes should not cause or contribute to water quality impairments.

Strategy 1: CAFO facilities are required to obtain Missouri State Operating Permits. These permits will serve as the primary mechanism for TMDL implementation for these sources. CAFO permits contain stringent technical standards that must be followed and relate to the handling and land application of animal manure. Requirements in these permits include, among other things, specifications for storage structures, a nutrient management plan, and setback distances for land applications. General descriptions of these and other CAFO-related BMPs are available on the department's website at dnr.mo.gov/env/wpp/cafo/docs/cafo-bmp.pdf. Properly conducted land applications made with considerations of soil surface conditions and existing nutrient content will aid in reducing bacteria loading from CAFO sites.

Strategy 2: The department also provides BMPs for the temporary stockpiling of dry wastes when land applications are not practical at dnr.mo.gov/pubs/pub2503.htm. Additional BMPs related to manure management and animal feeding operations are available online from the University of Missouri Extension office at nmplanner.missouri.edu/.

Strategy 3: The transfer of manure wastes outside of the watershed can also help alleviate loading to water bodies in the Chariton River watershed, but such actions should be completed in a manner than considers the water quality impacts and nutrient needs in the recipient watershed.

6.1.3 – Illicit (Illegal) Straight Pipe Dischargers

Background: Due to the illegal nature of these types of discharges, straight-pipe discharges are not assigned a portion of the overall loading capacity.

Objective: The complete elimination of these sources is consistent with the TMDL wasteload allocation of zero.

Strategy: Incidences of straight pipe discharges are typically handled by regional continuing authorities, such as a permitted municipal wastewater treatment facility, and most cities have ordinances requiring homeowners to connect to the sewer system when within a certain distance. In rural areas, local county health departments or the Missouri Department of Health and Senior Services may serve as the proper authority for halting such discharges. The Department of Health and Senior Services can be contacted by telephone at 866-628-9891or by email at mailto:info@health.mo.gov. Contact information for county health departments in the watershed is provided in Table 4.

Table 4. County health department contact information

County	***Address***	***Phone***
Adair	1001 S. Jamison, Kirksville, MO 63501	660-665-8491
Chariton	206 State St., Keytesville, MO 65261	660-288-3675
Linn	635 S. Main St., Brookfield, MO 64628	660-258-7251
Macon	503 N. Missouri St., Macon, MO 63552	660-395-4711
Putnam	103 N. 18th St., Unionville, MO 63565	660-947-2429
Schuyler	213 S. Green St., Lancaster, MO 63548	660-457-3721
Sullivan	101 Hawthorne Dr., Milan, MO 63556	660-265-4141

Chariton River downstream of Highway 6 west of Kirksville

6.2 - Nonpoint Source Implementation

The department does not regulate nonpoint sources through permits. Nonpoint source loading is reduced using voluntary BMPs that can be implemented to address and improve land use practices that may be contributing bacteria to the impaired water bodies. Nonpoint source load reductions can be achieved from individual actions and BMP implementation from any place throughout the watershed, but may be more substantial and effective in restoring water quality when organized by locally led watershed groups or local governments who have developed a watershed-based management plan and have identified critical areas within the watershed. The department supports the development of nonpoint source watershed management based plans through competitive EPA funded subgrants. More information about the department's Section 319 Nonpoint Source Implementation Program is available online at dnr.mo.gov/env/swcp/nps/index.html or by calling 573-751-7428. The University of Missouri Extension also provides guidance and support for communities and citizens to develop organized watershed groups. Information regarding this program is available online at fsb.missouri.edu/extension/waterquality/.

Nonpoint sources primarily contribute bacteria loads at flows influenced by precipitation events through contaminated stormwater runoff and the erosion of bacteria contaminated sediments. For this reason, BMPs that reduce runoff and erosion will be the primary means of achieving load reductions from nonpoint sources to meet the target load allocations. However, failing onsite wastewater treatment systems and direct waste inputs from animals that are not excluded from waterways can contribute bacteria loads under dry conditions as well. Therefore, BMPs that reduce bacteria loading at lower flows may also help to attain water quality standards in Chariton River and Mussel Fork. Nonpoint sources of bacteria identified in the TMDL reports include failing onsite wastewater treatment systems and runoff from lands used for agricultural production.

6.2.1 – Onsite Wastewater Treatment Systems

Background: Failing onsite wastewater treatment systems may be sources of bacteria to nearby waterways during periods associated with either wet weather or dry weather flows depending upon the nature of the failure. Proper maintenance of onsite wastewater treatment systems, including septic tanks, associated drain fields, and household lagoons is the primary BMP for limiting bacterial inputs from these sources.

Objective: By design, properly functioning onsite wastewater treatment systems should not be contributing significant bacteria loads to surface waters. For this reason, the TMDL assigns a load allocation of zero to these potential sources.

Strategy 1: Educating homeowners about proper onsite wastewater treatment system maintenance. This may be provided by local governments, local watershed groups, or by university extension offices. The EPA maintains various guidance documents and resources pertaining to onsite treatment systems online at water.epa.gov/infrastructure/septic/homeowner-resources.cfm including a "Homeowner's Guide to Septic Systems." For onsite wastewater treatment systems that are already failing, repairs or even replacement of the system are necessary. Considerations should also be given to reducing reliance on onsite systems in favor of centralized systems.

Strategy 2: Local ordinances must be followed regarding permitting requirements pertaining to repairs, replacement or the installation of new systems. Where local ordinances are not in place, the department encourages their adoption. In counties without specific ordinances, state law and regulations must be

followed. A list of these state requirements is available on the Department of Health and Senior Services website at health.mo.gov/living/environment/onsite/lawsregs.php. Additional information regarding requirements for onsite systems can be obtained from state and county health departments using the contact information provided in Section 6.1.3 and Table 3 of this implementation plan.

6.2.2 – Agricultural Runoff

Background: Due to the large amount of land available for agricultural production in the watershed, stormwater runoff from these areas is a potential contributor of bacteria loading to surface waters in the Chariton River watershed.

Objective: The implementation of BMPs that will reduce soil erosion or the movement of manure or manure fertilizers from application sites will provide the greatest benefits in reducing bacteria loading from agricultural lands. Additionally, reducing direct bacteria inputs from livestock can also reduce nonpoint source bacteria loads. Critical areas where implementing such BMPs may show the greatest water quality benefit are presented in Figure 2 for the Chariton River and Figure 3 for Mussel Fork. Additional higher resolution maps focusing on 12-digit HUC subwatersheds in the immediate vicinity of the measured impairment can be found in the appendix. These critical areas represent agricultural areas where runoff potential is highest. This information should be supplemented with local knowledge of the watershed in order to select and appropriately site BMPs. These maps were compiled using available geographical information system, or GIS, data of hydrologic soil group runoff potential information and land cover data. This analysis uses more recent and updated information than what is presented in the Chariton River TMDL report, but corresponds with the information provided in Figures 2 and 5 of the more recently developed Mussel Fork TMDL report.

Strategy 1: To facilitate the implementation of agricultural practices in the watershed, the department has, through the Our Missouri Waters Initiative and the Regional Conservation Partnership Program, prioritized many of the subwatersheds within the Chariton River to receive funding from the Natural Resources Conservation Service, or NRCS, for farm conservation practices to improve water quality and wildlife habitat in those areas. Although the focus of the prioritization is to reduce nutrients and sediments from entering surface waters, many of the erosion-control BMPs used for those purposes may also help to reduce bacteria loading from croplands or pastures. The funding period began on Oct. 3, 2014 and continues through Sept. 30, 2019. Table 5 provides generalized information on NRCS conservation practices implemented in the Chariton River since 2005. Information specific to the drainage area of the impaired segment of Mussel Fork is also included.

Strategy 2: Any voluntary BMP that is implemented to control erosion or limit the movement of animal manure from land areas can aid in the reduction of bacteria loading to surface waters in the Chariton River watershed. Examples of such BMPs are listed in Table 6.

Table 5. NRCS conservation practices implemented in the Chariton River watershed since 2005

Practice	*Units (number, acres or feet)*	*Cost*	*Watershed or Subwatershed*
Comprehensive nutrient management	4 no.	$31,901.00	Chariton River
Forest management plan	10 no.	$8,377.00	Chariton River
Waste storage facility	5 no.	$430,588.00	Chariton River
Brush management	170.5 acres	$7,017.00	Chariton River
Animal mortality facility	< 3 no.	< $20,000	Chariton River
Conservation cover	37.8 acres	$6,290.00	Chariton River
Cover crop	352.1 acres	$10,675.00	Chariton River
Fence	118,967.2 feet	$87,354.00	Chariton River
Grassed waterway	< 5 acres	< $5,000	Chariton River
Access control	346.9 acres	$4,970.00	Chariton River
Forage and biomass planting	4,857.2 acres	$203,819.00	Chariton River
Prescribed grazing	3,171 acres	$34,178.00	Chariton River
Heavy use protection area	< 5 acres	< $2,000.00	Chariton River
Stream crossing	< 3 no.	< $5,000.00	Chariton River
Nutrient management	1,822.3 acres	$48,475.00	Chariton River
Terrace	150,638 feet	$266,069.00	Chariton River
Tree and shrub establishment	< 5 acres	< $500.00	Chariton River
Waste utilization	1,837.9 acres	$13,223.00	Chariton River
Waste transfer	12 no.	$179,191.00	Chariton River
Water and sediment control basin	37 no.	$48,403.00	Chariton River
Watering facility	2 no.	$2,068.00	Mussel Fork
Manure transfer	1 no.	$15,500.00	Mussel Fork
Conservation Reserve Program (CRP)	3,642 acres	$199,985.00	Mussel Fork
Grassland Reserve Program (GRP)	422 acres	No info	Mussel Fork

Table 6. BMPs that may reduce bacteria loading in the Chariton River watershed

Best Management Practice	*Description*	*BMP Type*
Cover crops	Grass, grains, and legumes planted to reduce surface erosion.	Cropland
Nutrient management plans	Managing the amount, placement, and timing of manure fertilizer applications.	Cropland
Conservation crop rotation	Growing various crops on the same land in a planned rotation in order to reduce erosion.	Cropland
Grassed waterways	A grassed strip to prevent gully formation.	Cropland
Terraces	An earthen embankment across the slope of a field to intercept runoff and trap soil.	Cropland
Vegetative Buffers	Permanently vegetated areas that reduce sediment loss.	Cropland
Water retention structures	Structures to control runoff and prevent erosion	Cropland
Off-stream watering systems	Watering system away from streams or ponds. Reduces livestock that will enter a stream for water.	Livestock

Rotational grazing	Rotating livestock within a pasture to spread manure more uniformly and allows grass to regenerate.	Livestock
Relocate pasture feeding sites	Move feeding sites away from streams to reduce manure near stream.	Livestock
Grazing management plans	Designed to avoid increased erosion caused by over grazing.	Livestock
Relocate feeding pens	Move feeding pens away from streams to reduce manure near stream.	Livestock
Fence off streams and ponds	Prevent livestock from entering waterways	Livestock
Vegetative filter strips	Vegetated areas that receive runoff from animal operations	Livestock

Cropland in the Chariton River watershed

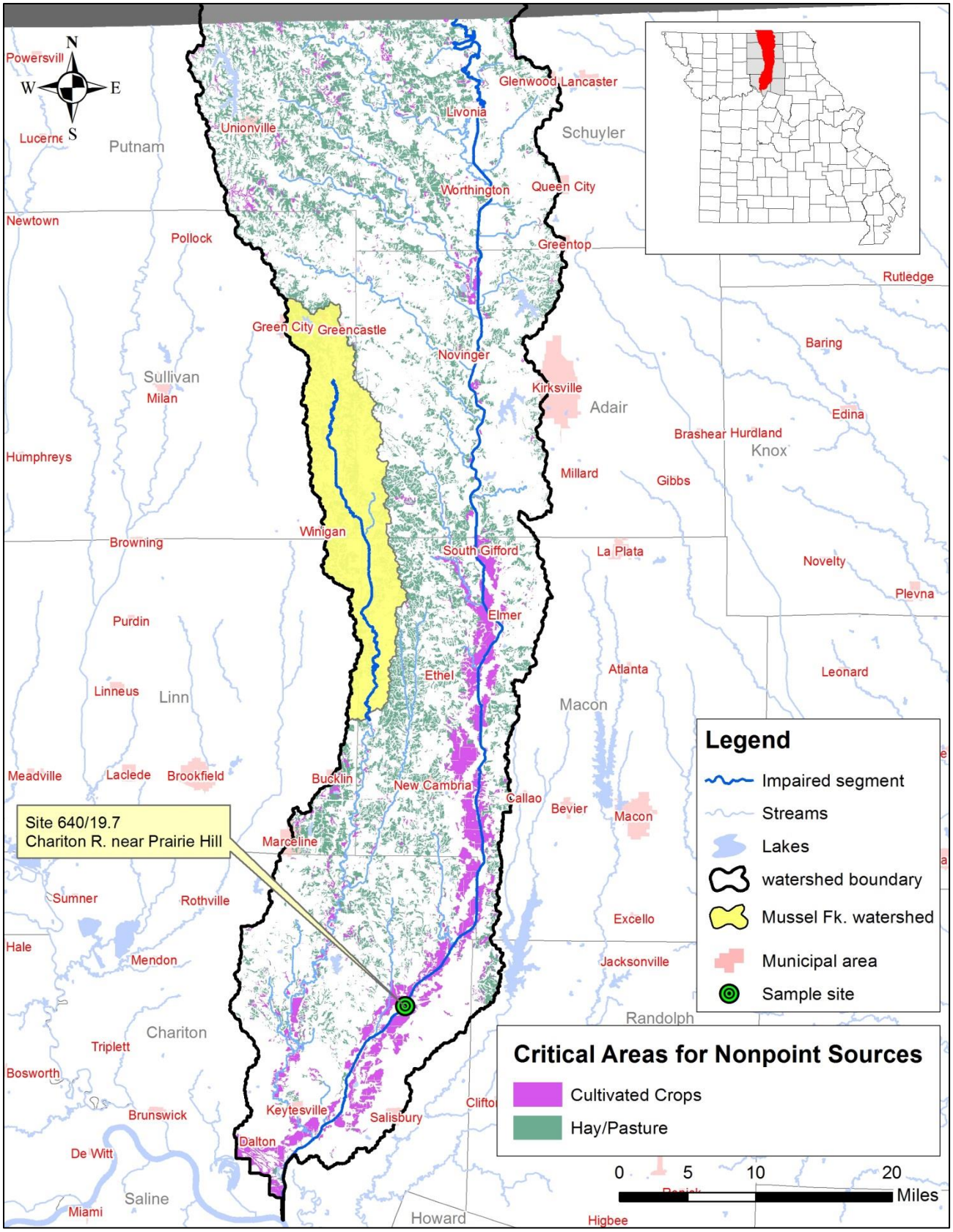

Figure 2. Critical areas for nonpoint source BMP implementation in the Chariton River watershed

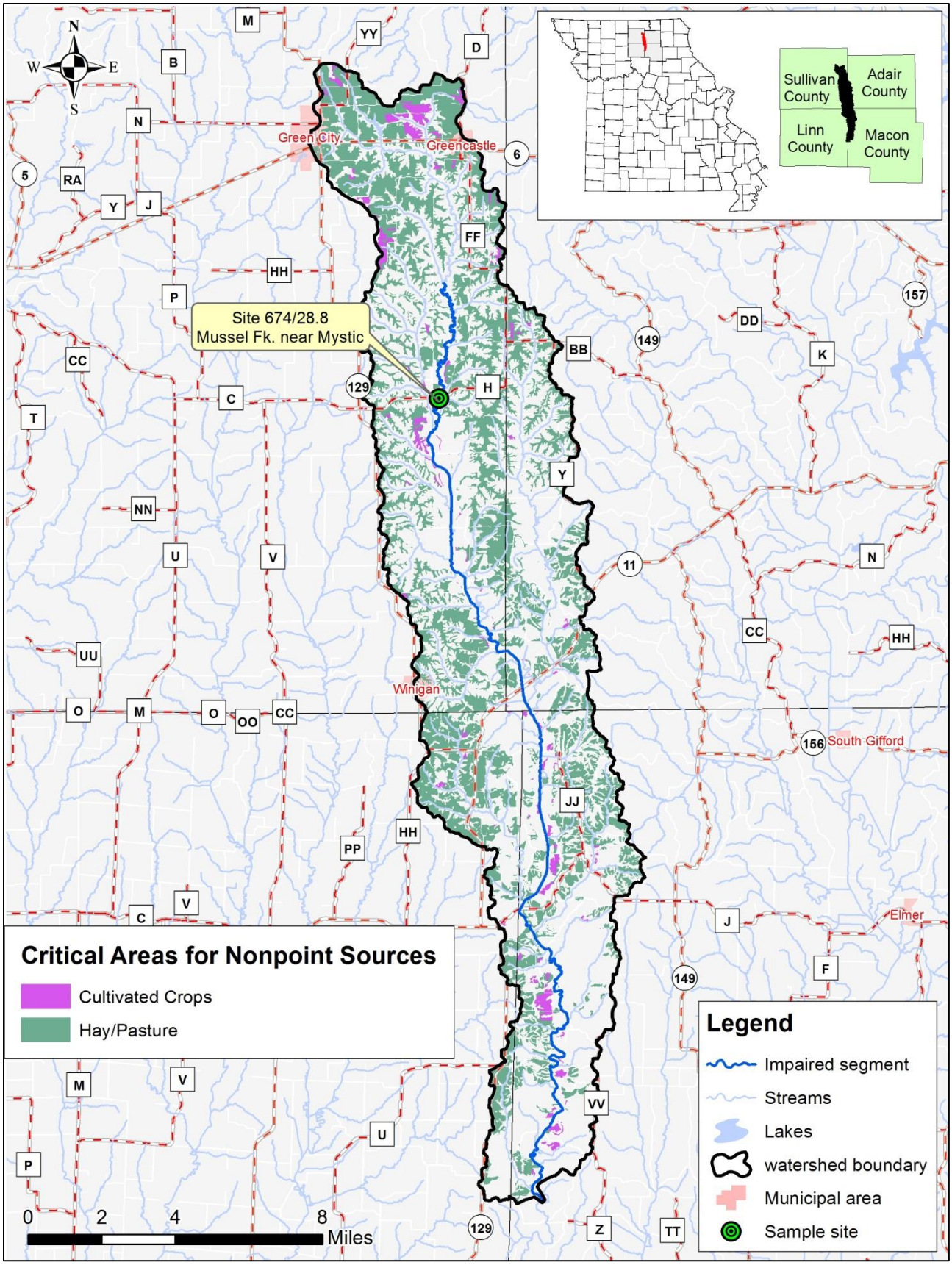

Figure 3. Critical areas for nonpoint source BMP implementation in the Mussel Fork watershed

7 – Costs of Implementation and Potential Funding Sources

TMDLs are written to meet applicable water quality standards per 40 CFR 130.7(c)(1), and this is done absent of cost considerations and available treatment technologies. Despite this, facility upgrades and installations of BMPs do have costs associated with them that usually need to be considered before determining the extent necessary to meet the specified TMDL targets. For point sources, costs for implementing bacteria reductions typically result from the need for wastewater treatment facilities to install and maintain disinfection systems or from BMPs needed to meet CAFO permitting requirements. For nonpoint sources, costs associated with bacteria loading reductions are typically associated with the voluntary installation and maintenance of BMPs to reduce erosion and stormwater runoff, as well as those used to reduce impacts from livestock. These costs are variable and dependent upon the type, number, and complexity of the practice or repair. Fortunately, a single BMP can often be utilized to address several pollutants, thereby providing additional benefits to compensate for overall costs. Estimates of BMP costs are available online from the International Stormwater BMP Database at bmpdatabase.org. Other costs potentially associated with nonpoint source implementation are those associated with maintenance, repair, or replacement of onsite wastewater treatment systems. Such costs are variable depending upon local conditions.

For municipal wastewater treatment facilities, Section 644.145 of Missouri Revised Statutes requires the department to make a "finding of affordability." During the permitting process the department will complete a cost analysis for compliance to estimate costs associated with installation, operation, and maintenance of a disinfection system. Table 7 provides such estimates for the municipal wastewater treatment facilities in the Chariton River watershed that do not have *E. coli* limits in their operating permits. These estimates are provided in this implementation plan for informational purposes only and may differ from the estimated costs determined at the time of permit renewal. The estimates presented in this implementation plan were calculated using the department's 2014 Cost Estimate for Compliance Spreadsheet developed by HydroMantis preliminary cost estimate software, CapDet Works version 2.5. Non-municipal domestic wastewater dischargers will need to contact private engineering firms to determine the costs associated with disinfection for those systems.

Table 7. Estimated disinfection system costs for municipal wastewater dischargers

Facility Name	***Permit No.***	***Design Flow (MGD)***	***Chlorination***		***Ultraviolet***	
			Capital Cost	***Annual O&M Costs***	***Capital Cost***	***Annual O&M Costs***
Bucklin East WWTF	MO-0085928	0.0654	$934,384	$63,166	$1,056,672	$74,804
Green Castle Lagoon System	MO-0103322	0.0265	$718,200	$57,841	$132,000	$4,089
Green City WWTF	MO-0112135	0.1000	$1,090,000	$66,550	$132,000	$4,089
New Cambria WWTF	MO-0094706	0.0390	$796,900	$59,913	$132,000	$4,089

Due to the costs associated with pollutant reduction and water quality improvement, a variety of grant and loan programs have been established to assist watershed stakeholders. The most commonly used sources of funding are low-interest loans through the State Revolving Fund, Section 319 subgrants, and cost-share practices through the state's Soil and Water Conservation Program.

Low-interest loans from the State Revolving Fund program through the department's Water Protection Program Financial Assistance Center may be available. The State Revolving Fund provides low-interest loans to municipalities, counties, public sewer districts and political subdivisions for wastewater infrastructure projects. Projects may be new construction or the improvement or renovation of existing facilities. An onsite loan program to provide county or municipal governments with funding for addressing onsite wastewater treatment systems is currently under development. More information regarding the State Revolving Fund Program is available online from the department's Water Protection Program Financial Assistance Center website at dnr.mo.gov/env/wpp/srf/index.html.

By amendment to the federal Clean Water Act in 1987, the Section 319 grant program was established to provide funding for efforts to reduce nonpoint source pollution. EPA provides 319 funding to the state, which in turn allocates a portion of the funding as subgrants to public and nonprofit organizations to address nonpoint source concerns. Section 319 funded subgrants must be used to implement an accepted watershed management plan and by doing so may be used to demonstrate innovative best management practices, support education and outreach programs, restore impaired waters, or protect waters from becoming impaired. In some cases, nonpoint sources for Section 319 purposes may differ from those outlined in the TMDL. For example, urban runoff regulated by an MS4 permit is considered a point source, but in some instances can be considered a nonpoint source for Section 319 purposes. More information regarding the Section 319 Nonpoint Source Implementation Program is available online at dnr.mo.gov/env/swcp/nps/index.html.

The department's Soil and Water Conservation Program provides financial incentives to landowners to implement practices that help to prevent soil erosion and protect water quality. The program offers cost-share programs through its county conservation districts. Landowners can receive up to 75 percent reimbursement of the estimated cost of a practice through the program. The primary funding for cost-share practices from the Soil and Water Conservation Program comes from the one-tenth-of-one percent Parks, Soils and Water Sales Tax. More information regarding the Soil and Water Conservation Program and cost-share practices is available online at dnr.mo.gov/env/swcp/service/swcp_cs.htm.

In addition to these state sources of funding, federal assistance, public bonds and private financing may also be sources of available funding. The EPA maintains the Catalog of Federal Funding Sources for Watershed Protection, which is a searchable database of financial assistance sources. The link to this online catalog as well as other federal funding sources is provided in Table 8.

Table 8. Online resources for potential funding sources

Name & URL	***Description***
Catalog of Federal Funding Sources for Watershed Protection https://ofmpub.epa.gov/apex/watershedfunding/f?p=fedfund:1	Searchable data of financial assistance sources for watershed protection
Nonpoint Source – Related Funding Opportunities http://water.epa.gov/polwaste/nps/funding.cfm	List of federal websites with information regarding funding opportunities
Water: Grants & Funding http://water.epa.gov/grants_funding/	EPA website providing information about available grants

Watershed Funding http://water.epa.gov/aboutow/owow/funding.cfm	Funding resources and tools from EPA
Environmental Education Grants http://www2.epa.gov/education/environmental-education-ee-grants	Financial support for environmental education projects
Targeted Watershed Grants Program http://water.epa.gov/grants_funding/twg/initiative_index.cfm	EPA grant to increase citizen stewardship of urban waterways
Environmental Justice Grants http://www3.epa.gov/environmentaljustice/grants/	Grant resources for Environmental Justice communities
Center for Environmental Finance http://www2.epa.gov/envirofinance	Provides direction and leadership for developing innovative financing methods
Grants.gov http://www.grants.gov	A common website for federal agencies to post funding opportunities

USGS monitoring location on the Chariton River
(Telemetry equipment for discharge gage)

8 – Measurable Goals, Timeline and Milestones

TMDL implementation uses an adaptive management process that makes progress toward achieving water quality goals while using any new information to reduce uncertainty and adjust implementation activities. For this reason, progress toward meeting water quality standards in the Chariton River watershed is expected to be a long-term process and partially a continuation of current, ongoing or legally required activities, as well as any voluntary measures that may be planned or in place.

The goal of both the Chariton River and Mussel Fork TMDLs is to reduce bacteria concentrations to levels that will support whole body contact recreation. Reaching this goal will require reductions in existing *E. coli* loads to levels that will achieve applicable water quality criteria. Timelines and interim milestones for reaching this goal may vary depending upon the means of implementation, as well as the strategies used to address individual point or nonpoint sources. As part of the iterative and adaptive approach used in TMDL implementation, timelines may be adjusted as additional information becomes available and implementation strategies are refined.

As previously mentioned, TMDL implementation for point sources occurs through the issuance of Missouri State Operating Permits. When appropriate, federal regulations at 40 CFR §122.47 allow a permit to specify a schedule of compliance. Any schedules of compliance included in a permit for attaining *E. coli* water quality standards or for installation of disinfection technologies will serve as the necessary timeline and measurable goals for implementing the Chariton River and Mussel Fork TMDLs as they pertain to point source dischargers. Likewise, any schedules laid out in any existing or future court orders or enforcement actions taken upon a permitted entity to compel compliance with state water quality standards will also serve as a schedule for TMDL implementation.

For nonpoint sources, the inclusion of timelines, milestones and measurable goals is a required element for Section 319 nonpoint source watershed based plans. Any watershed based plans developed for waters in the Chariton River watershed should incorporate the goals established in the TMDLs and the schedules outlined in these plans will serve as a schedule for TMDL implementation. At the time of this writing, no Section 319 nonpoint source watershed based plans have been developed for waters within the Chariton River watershed.

Also pertaining to nonpoint sources, various measurable goals for BMP implementation were included in the department's proposal to receive the NRCS funding described in Section 6.2.2. Such goals included numbers of BMPs and acres of land managed as well as numbers of participants and reductions in erosion and soil loss. Such information may serve as milestones for implementation of the TMDLs on a limited and localized basis.

9 – Conclusion

The purpose of this TMDL implementation plan is to serve as a general guide to department staff, Soil and Water Conservation districts, local governments, permitted entities, watershed managers, and citizen groups for reducing existing bacteria loads in order to meet the loading targets established in the Chariton River and Mussel Fork TMDLs. The ultimate goal is to restore the bacteria impaired streams in the Chariton River watershed to conditions that meet water quality standards using an adaptive implementation approach that makes progress toward achieving water quality goals while using new data and information to reduce uncertainty and adjust implementation activities. Implementation efforts are expected to be long-term, occurring over a number of years, but also within the schedules established in state operating permits. Success in achieving water quality standards will be determined by the department through biennial assessments of water quality compliance as required by Sections 305(b) and 303(d) of the Clean Water Act.

An administrative record for the Chariton River *E. coli* TMDL and the Mussel Fork *E. coli* have been assembled and are on file with the department. The administrative record includes this implementation plan, the TMDL reports, and any studies, data and calculations on which the TMDLs are based. This information is available upon request to the department at dnr.mo.gov/sunshine-form.htm. Any request for information will be processed in accordance with Missouri's Sunshine Law (Chapter 610, RSMO) and the department's administrative policies and procedures governing Sunshine Law requests. For more information about open record/Sunshine requests, please consult the department's website at dnr.mo.gov/sunshinerequests.htm.

This implementation plan is scheduled for a 45-day public notice and comment period, from Dec. 23, 2016 to Feb. 6, 2017, in conjunction with the comment period for the Mussel Fork *E. coli* TMDL. Any comments received and the department's responses to those comments are to be maintained on file with the department and are to be posted online at dnr.mo.gov/env/wpp/tmdl/0674-mussel-fk-ck-record.htm. The department maintains an email distribution list via GovDelivery.com for notifying subscribers regarding significant TMDL updates or activities. Those interested in subscribing to these TMDL updates may do so by submitting their email address in the online form at public.govdelivery.com/accounts/MODNR/subscriber/new?topic_id=MODNR_177.

10. References

Brown, E., Caraco, D. and R. Pitt. 2004. Illicit Discharge Detection and Elimination a Guidance Manual for Program Development and Technical Assessments. EPA X-82907801-0

EPA (U.S. Environmental Protection Agency) 2012. Considerations for Revising and Withdrawing TMDLs. Available URL: www.epa.gov/tmdl/draft-considerations-revising-and-withdrawing-tmdls

EPA (U.S. Environmental Protection Agency). 2006. Memorandum: Establishing TMDL "Daily" Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in *Friends of the Earth, Inc. v. EPA, et al.*, No. 05-5015, (April 25, 2006) and Implications for NPDES Permits. Available URL: www.epa.gov/sites/production/files/2015-10/documents/2006_11_21_tmdl_anacostia_memo111506.pdf

Appendix

Localized 12-digit Subwatershed Maps of Critical Areas for Nonpoint Source BMP Implementation

The maps on the following pages present, at a more detailed resolution, the critical areas associated with agricultural land uses in the subwatersheds of the Chariton River and Mussel Fork watersheds from which water quality data indicating impairment has been collected. Critical areas were broadly determined based on available land cover and soils data. The critical areas presented in this implementation plan should be supplemented with local knowledge of the watershed in order to select and appropriately site BMPs.

Chariton River

Mussel Fork

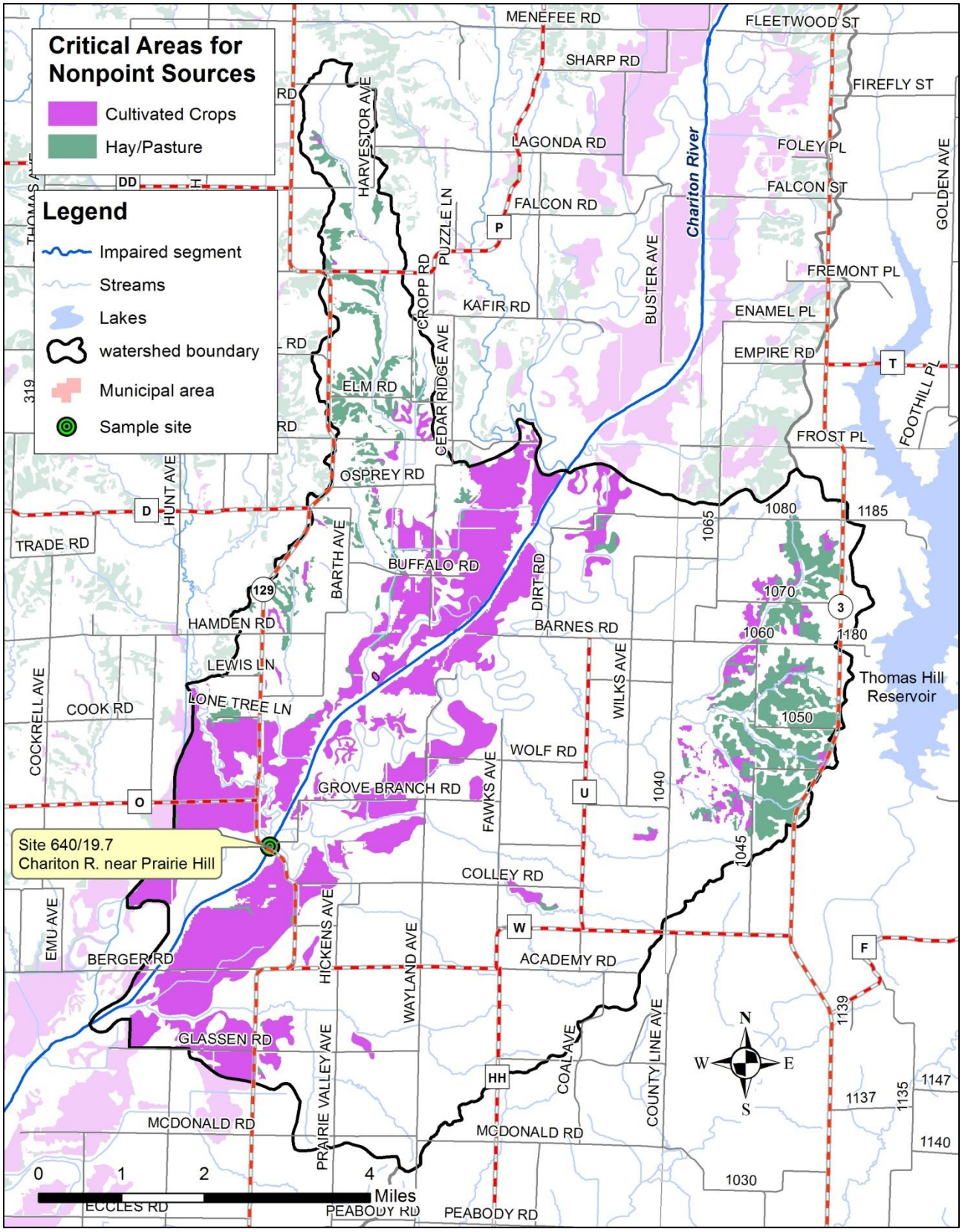

Figure A-1. HUC 102802020407 – Elm Branch-Chariton River

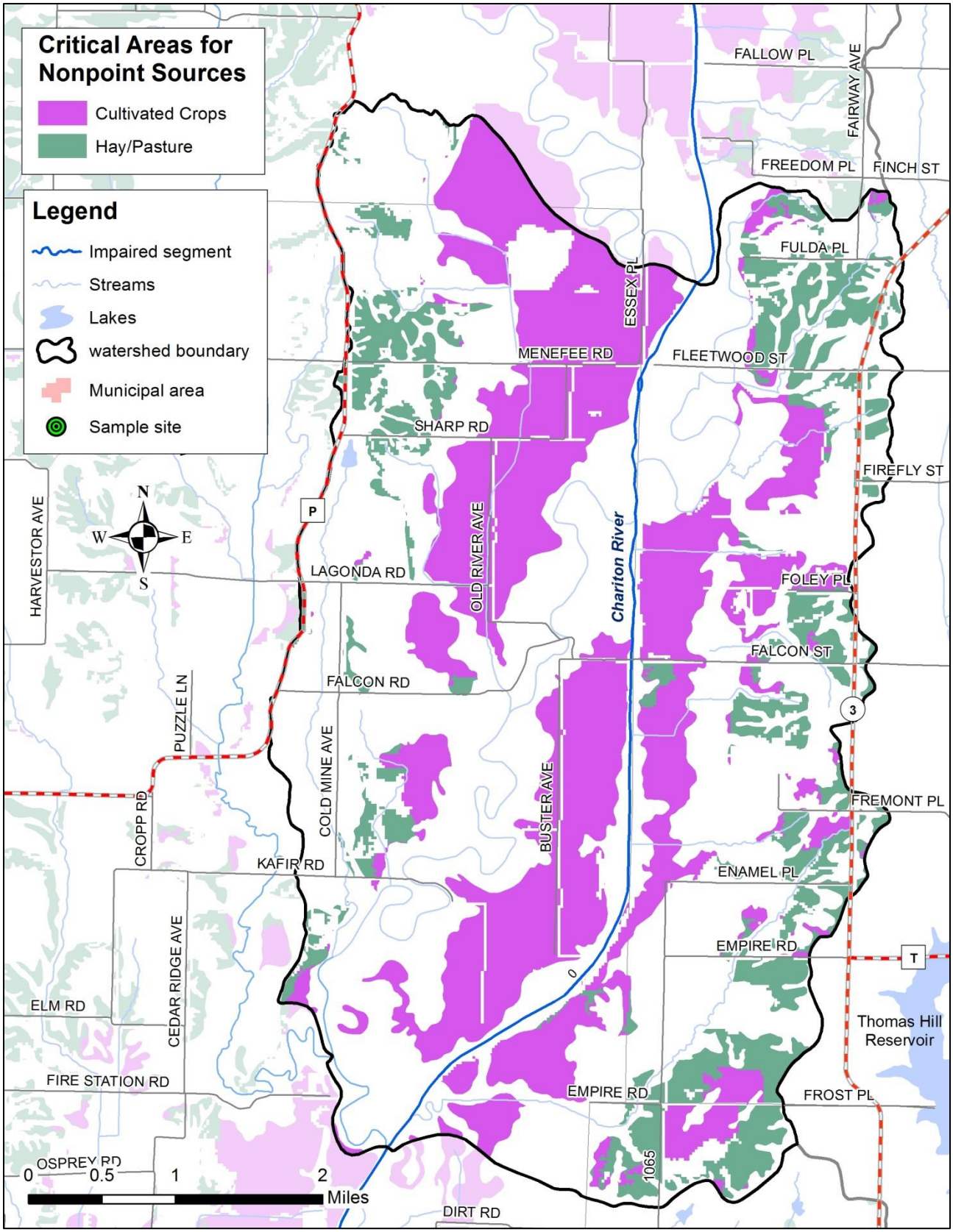

Figure A-2. HUC 102802020405 – Sleepy Hollow-Chariton River

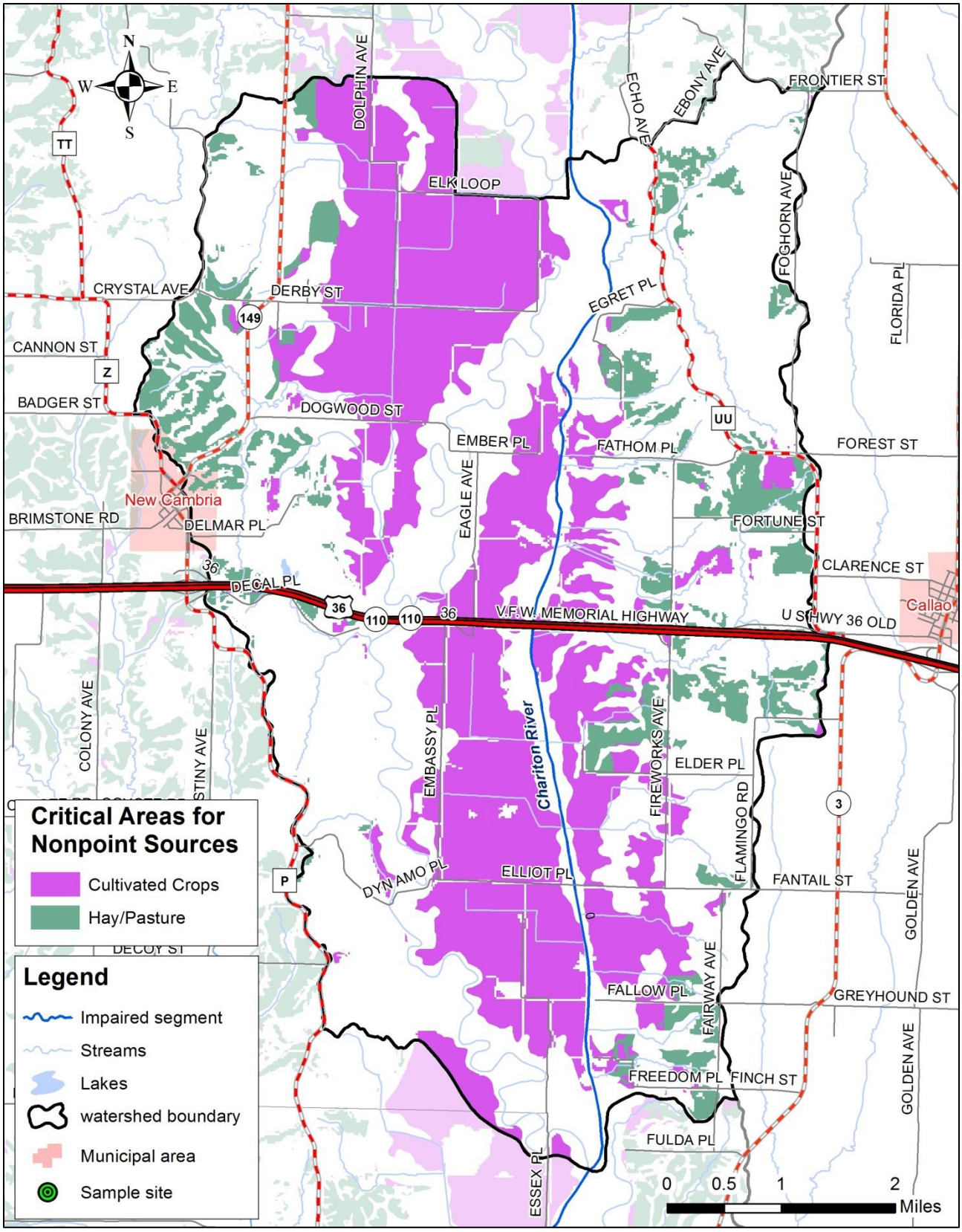

Figure A-3. HUC 102802020403 – Elam Creek-Chariton River

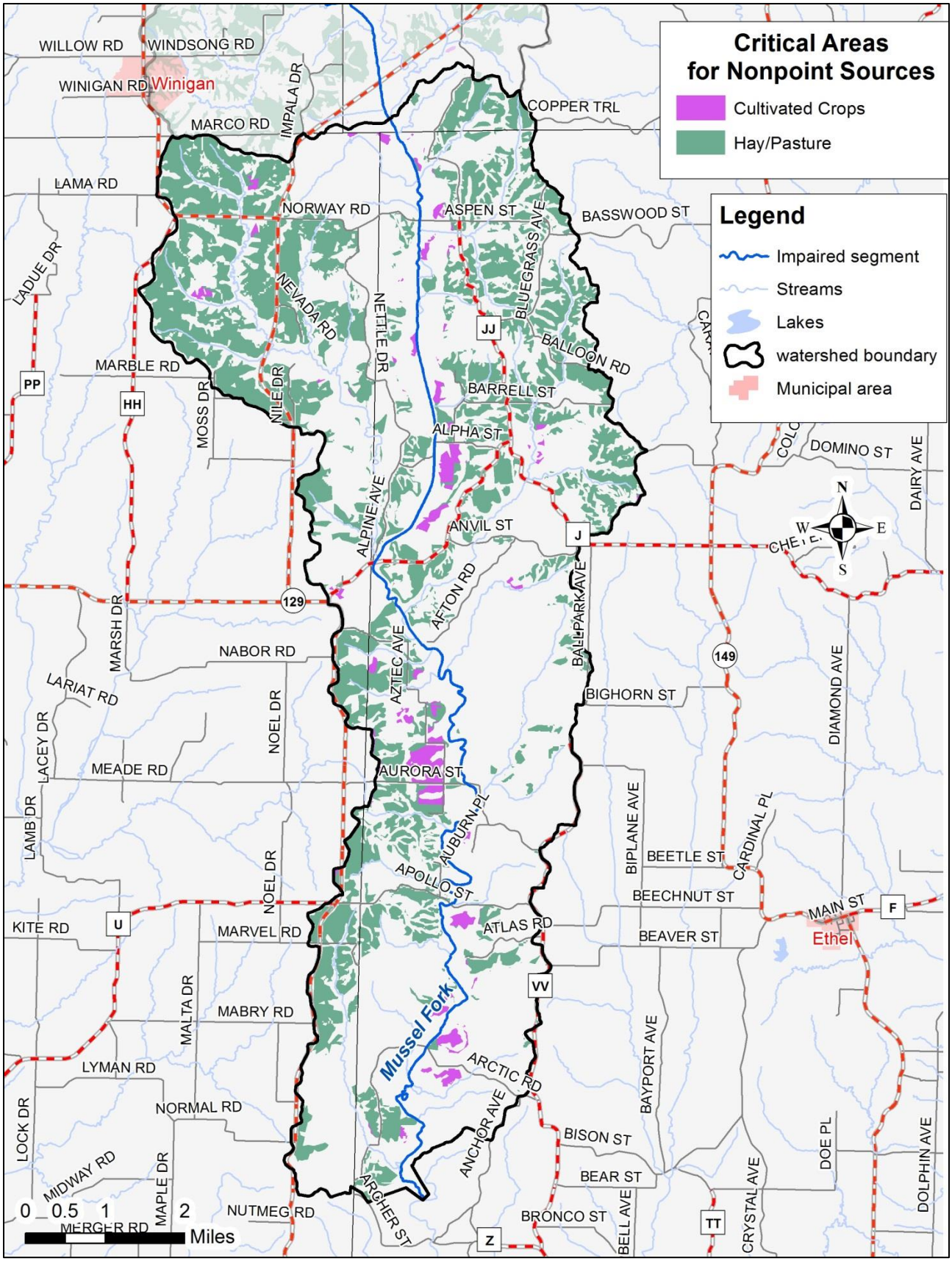

Figure A-4. HUC 102802020303 – Painter Creek-Mussel Fork

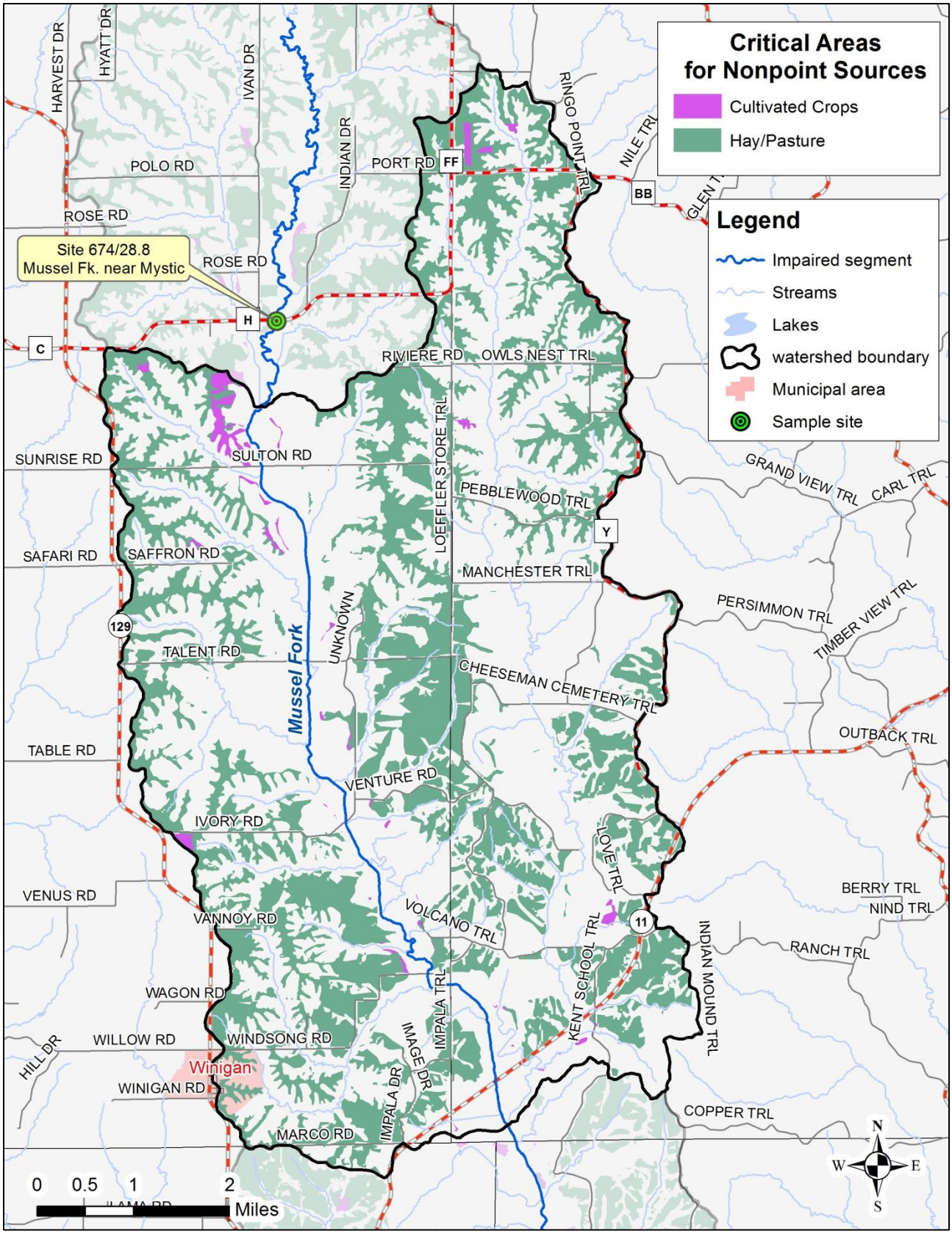

Figure A-5. HUC 102802020302 – Little Mussel Creek-Mussel Fork

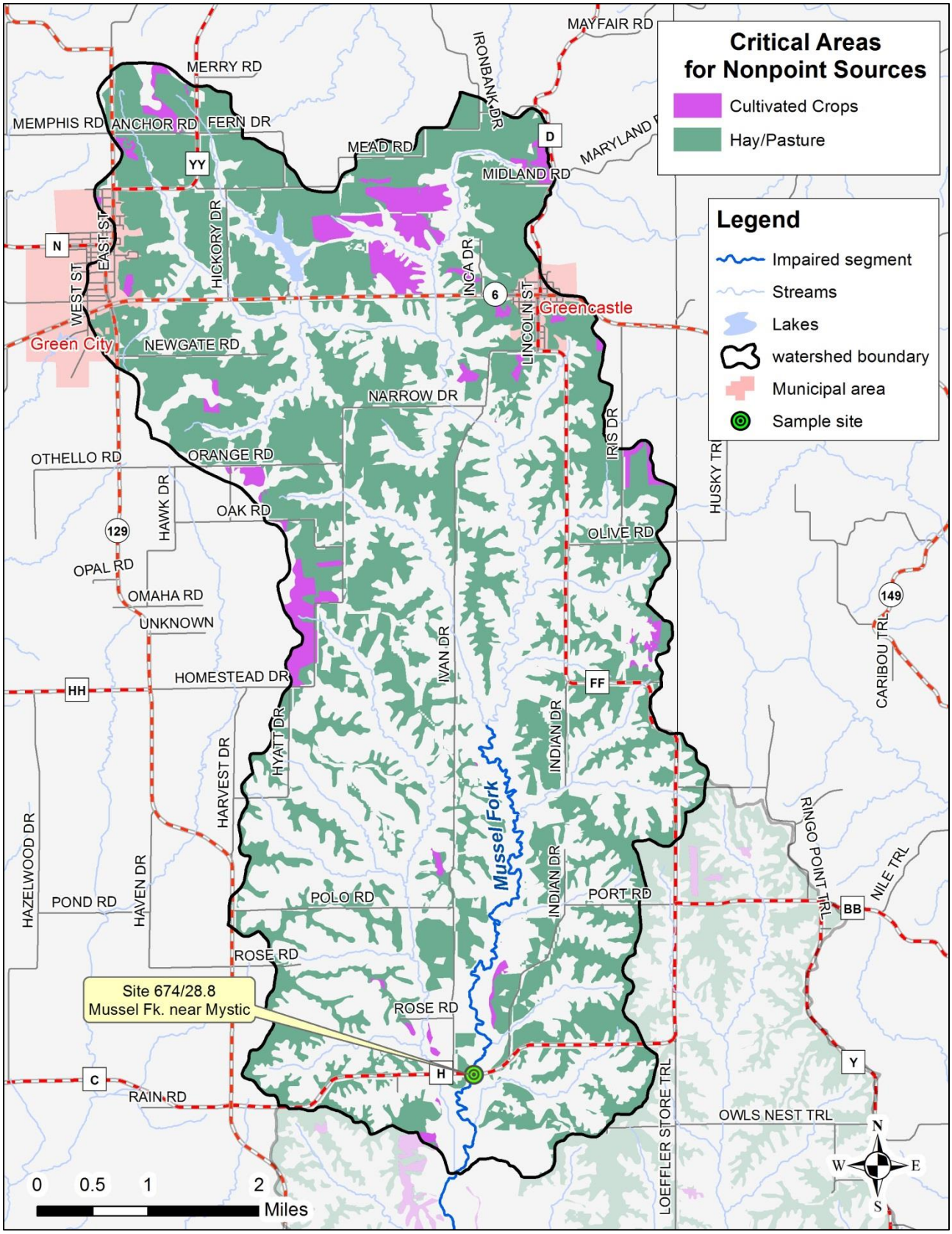

Figure A-6. HUC 102802020301 – Headwaters of Mussel Fork